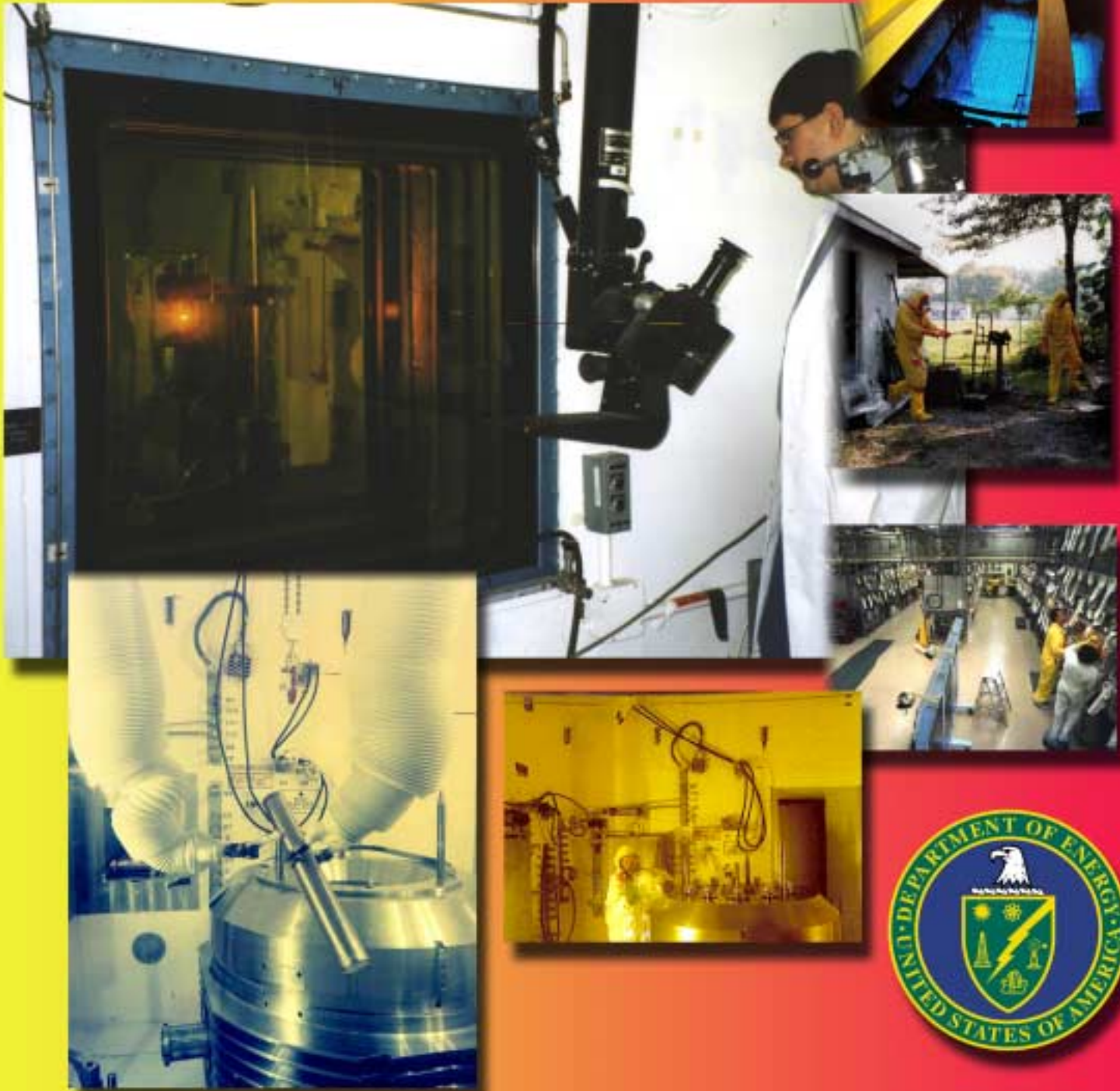


# ***Fernald Sealed Source Disposal Plan***

**By the  
Nonactinide Isotopes  
and Sealed Sources  
Management Group**



## **Fernald Environmental Management Project (FEMP) Sealed Sources and Standards Disposal**

### **History**

On January 20, 1998, DOE-EM chartered the Nuclear Material Integration Project (NMI) to identify EM's nuclear material inventories and determine disposition paths for excess nuclear materials. NMI created three material evaluation teams to undertake this project and to prepare material-specific management plans. The Non-actinide Isotope and Sealed Source (NISS) Team, one of the three teams, was assigned responsibility to evaluate all radioactive isotopes with an atomic number less than 90, and all sources, samples, and standards, irrespective of atomic number. This Team reported its findings in the Material Management Plan Nonactinide Isotope & Sealed Sources<sup>1</sup>.

A number of other radionuclides of elements with atomic number 90 or greater were also evaluated as NISS materials because: (1) they are not part of the Nuclear Materials Management and Safeguards System (NMMSS); (2) they are sealed sources; (3) they are neutron sources; or (4) they are located at small sites (such as Fernald).

The initial evaluation of NISS materials conducted during the preparation of the NMI NISS Material Management Plan<sup>1</sup> in 1998 (based on 1996 NMIA data) defined 10 NISS material streams at Fernald containing over 1500 items requiring disposal.

As a follow on activity to NMI and to provide DOE corporate assessment and technical assistance capabilities complex-wide, a Non-actinide Isotope and Sealed Source Management Group (NISSMG) has been formed under the Nuclear Material Stewardship Program.

In June of 2000 the FEMP Field Office requested support from the NISSMG to develop a suite of disposition baseline alternatives for FEMP NISS materials.

FEMP has recently (June 2000) completed a site wide inventory and assessment of NISS materials. There are currently 622 NISS material items at Fernald, of which 25 are active and still in use. Funding for disposal activities has not been included in the FEMP baseline. However, the historical cost data associated with the disposal of similar items included in this report will provide a basis for estimating these costs. As a first step, the remaining 597 items were sub-divided, consistent with NISS MMP methodology, into 8 material streams for disposal purposes. The initial subdivision is based on radiation and chemical characteristics. It was also advantageous to categorize the materials according to accountability criteria and common disposition path pathways.

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<sup>1</sup>“Material Management Plan Nonactinide Isotope and Sealed Sources” December, 1998

## Description of Disposal Pathways by Material Stream - FEMP

### Actinide Sources-1

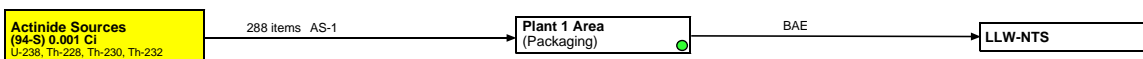
This material stream consists (AS-1) of 288 sealed sources and four different isotopes (U-238, Th-228, Th-230, and Th-232). Typically, sealed actinide sources are used as calibration sources, and some reuse options within the DOE complex may exist. In lieu of reuse, disposal of these materials as low level waste (LLW) is the most reasonable approach. This assumes these materials all meet the following definition: "Sources where the radioactive material is contained in a sealed capsule, sealed between layers of non radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means."<sup>2</sup>

Provided these sources meet the above definition, the following criteria would apply: "Sealed sources that have an

activity of 3.7MBq (100uCi) or greater shall be offered for disposal as individual waste stream and shall not be included as a sub-part of another waste stream. Sealed sources that are less than 3.7MBq (100uCi) can be mixed with other waste streams such as contaminated trash."<sup>2</sup>

Historical cost to provide the required data and waste profile to meet the Nevada Test Site (NTS) Waste Acceptance Criteria (WAC) for these types of sources are in the \$50 -\$100 per source range. Shipping cost will also need to be accounted for, however with the large volumes of LLW FEMP is shipping to NTS these costs should be insignificant. Additionally, NTS disposal cost will need to be included.

**Recommendation: Dispose of these 288 items as LLW at NTS.**



### Actinide Sources -2

The 56 Am-241 sources included in this material stream (AS-2) can be processed in the Savannah River canyons, sent to the Isotope Production Program at ORNL, or reissued for programmatic use. However, the complex has significant quantities of Am-241 in storage and reuse of Am-241 is very unlikely. Processing the FEMP sources at SRS is not a cost effective option.

Direct disposal at WIPP or NTS are the most promising options. Those sources that do not meet the TRU criteria of 100

nano curie per gram can be disposed of as LLW, however "All sealed sources containing transuranic nuclides must be evaluated against the Nevada Test Site Waste Acceptance Criteria (NTS WAC) TRU waste criteria individually."<sup>2</sup>

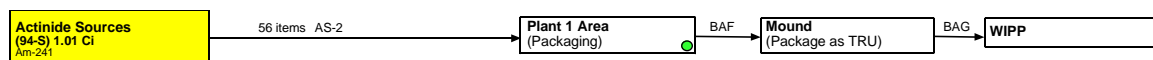
<sup>2</sup> "Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources" Revision 2, October 1997 DOE/NV Radioactive Waste Acceptance Program and the NTSWAC Working Group

There are two direct disposal options for the FEMP Am-241 sources and it is recommended that those sources that do not meet the NTSWAC TRU criteria be disposed of as LLW, and those sources which are categorized as TRU waste be transferred to the Mound TRU program for disposal.

Historical cost for disposal of transuranic sources as LLW are in the \$100-\$150 per source range which provides for the waste profile and for

packaging the sources. Shipping and NTS disposal cost would also need to be added. While WIPP does not charge a fee for emplacement or transportation, historical costs for establishing a TRU Waste certification program meeting the WIPP criteria are on the order of ~\$1M. Characterization meeting the WIPP WAC for each drum typically costs ~\$50K. Clearly, these costs drive the recommendation to utilize the same TRU waste disposal path as Mound.

**Recommendation: Transfer these 56 items to the Mound TRU Program and dispose as TRU waste**



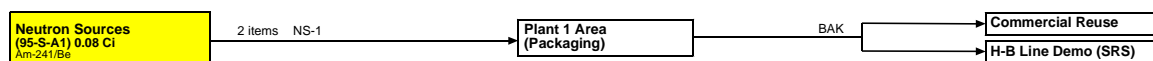
### Neutron Sources –1

Fernald has two AM/Be neutron sources (NS-1) and both are contained in level gauges. These gauges are new equipment and have not been in service. Previously, some neutron sources were processed for disposal by the Radioactive Source Recovery Program at LANL, however this program has evolved into the Off-Site Source Recovery Program and is no longer taking DOE sources. The Isotope Production Program at ORNL takes some neutron sources but not Am/Be sources. There are two options for the FEMP neutron sources: the first, return the source to the private sector via the original vendor or companies specializing in neutron source production; and the second option would

make the FEMP sources part of demonstration project for processing neutron sources for disposal using the one liter dissolver in H canyon at SRS.

Costs to utilize the one liter dissolver are yet to be determined. Historical costs for returning neutron sources to the private sector are disconcerting. New small curie neutron sources cost a few thousand dollars, to return one to a supplier the costs can be in the 10 thousand dollar range.

**Recommendation: Pursue reuse options via original vendor or other DOE Site.**



### Orphan Sources –1

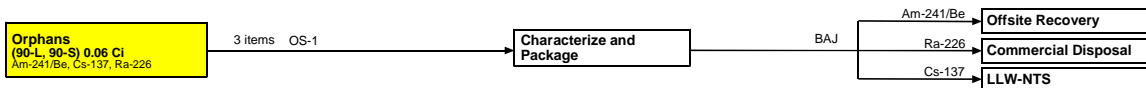
The FEMP inventory describes the orphan sources (OS-1) as 3 items: the first as a Am-241/Be neutron source; the second as a Cs-137 gamma source; and the third as a Ra-226 source.

The Am-241/Be neutron source could follow the same disposition path as NS-1 described above, or where this source was received as an abandoned NRC source from the State of Ohio, it may be eligible for the “Off-Site Source Recovery” Program. Mound has successfully exercised this pathway for the “Cambridge” sources. The Cs-137 source can be disposed of at NTS as LLW. The Ra-226 source can be disposed of as “Naturally Occurring Radioactive Material” (NORM) at the

US Ecology disposal site in Richland, WA via ATG, Inc.

Historical disposal costs for the Ra-226 sources are in the \$1500 per source range which includes writing and submitting the NORM determination letter as required by US Ecology. This price does not include transportation costs. Cost for neutron source disposal would be consistent with those in NS-1. If the Cs-137 source can be included in other shipments of LLW to NTS then disposal cost should be consistent with those items in AS-1.

**Recommendation: Utilize the “Off-Site Source Recovery” program for the neutron source disposal; dispose of the Ra-226 as NORM at US Ecology; and the Cs-137 can be disposed of LLW at NTS.**





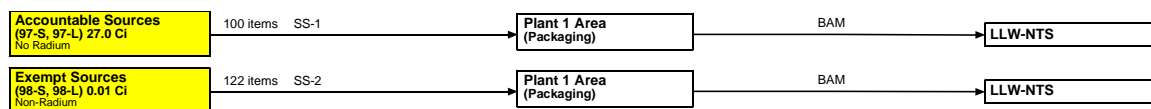
### Accountable and Exempt Sources

This stream (SS-1 & SS-2) is made up of 222 items with very small amounts of various isotopes. Most small sources (both accountable and exempt) can be disposed as LLW. In reviewing the 222 items in the FEMP inventory, it is expected that all of these sources could be packaged in a single container and shipped to NTS for disposal as LLW. Documentation and certification exists for these items and should easily support the preparation of a waste profile meeting the NTSWAC. However in the interim, the NISSMG will try to exercise every opportunity to reprogram sources

to programmatic use within the DOE. A part of this effort is already underway with discussions between ANL-W and FEMP staff of possible use of excess sources.

Historical cost to prepare the waste profile and package these types of sources is in the \$50 - \$100 per source range, exclusive of shipping and NTS charges.

**Recommendation: All 222 of these sources can be disposed of as LLW at NTS. In the interim pursue reuse options with other DOE Sites.**

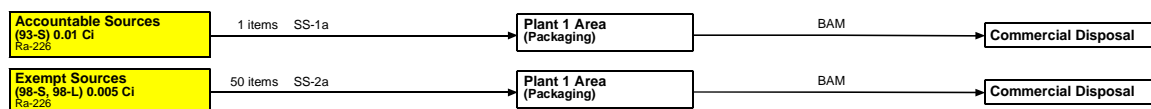


### Accountable and Exempt Sources –2

This stream (SS-1a & SS-2a) is made of 51 items. Although radium 226 (Ra-226) is included in the Performance Assessment of both NTS and Hanford LLW disposal sites, this particular isotope is treated in a very conservative manner. It has been the NISSMG experience that disposal of Ra-226 as “Naturally Occurring Radioactive Material” (NORM) at the US Ecology disposal site in Richland, WA via ATG, Inc. is a much more feasible approach.

Historical cost for utilizing the disposal path are in the \$1500/source per range. This does not include shipping or site disposal charges.

**Recommendation: Utilize the disposal path of NORM at US Ecology via private sector.**



## **Conclusion**

While disposal options are available for all Fernald NISS materials, the NISSMG is continuing to enhance and pursue more cost effective means of disposal. Included in these activities are near term actions that include close coordination with the LLW disposal sites at NTS and Hanford to resolve any issues, including those associated with Ra-226 disposal. Resolving the Ra-226 issues could provide Fernald with a more cost effective disposal option for this material. Additional activities are also underway seeking resolution to neutron source disposal issues. The NISSMG will continue to support Fernald disposal activities by providing updates to Fernald on improved disposal options throughout the DOE complex.

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